CLAIMS

We claim:

1. A gain equalizer comprising:

an input port receiving light comprising at least two wavelength components;

a first dispersive element receiving said light and spatially dispersing said wavelength components of said light along a dispersion direction;

a plurality of variable optical attenuating elements disposed generally along said dispersion direction, such that each of said attenuating elements is traversed by a different wavelength component of said light;

a second dispersive element receiving light after passage through at least part of at least one of said plurality of variable optical attenuating elements, and operative to combine said wavelength components of said light into an output beam; and

an output port receiving said output beam;

wherein at least one of said variable optical attenuating elements comprises a variable phase changing element operative to change the phase of part of the cross section of light passing through it.

2. A gain equalizer according to claim 1, and wherein at least one of said attenuating elements is varied such as to vary the level of light traversing said attenuating element.

3. A gain equalizer according to claim 1 and wherein at least one of said input and output ports is an optical fiber.

4. A gain equalizer according to claim 2 and also comprising a controller operative to vary the attenuation of at least one of said variable attenuating elements, such that the light passing through said attenuating element has a predefined level.

5. A gain equalizer according to claim 4 and also comprising a spectrally selective detector providing to said controller at least one signal corresponding to the power level of at least one of said wavelength components.

6. A gain equalizer according to claim 5 and wherein said at least one signal is utilized to adjust the attenuation of at least one of said variable attenuating elements.

7. A gain equalizer according to claim 5 and wherein said detector is located such that it measures the power level of at least one of said wavelength components in said output beam.

8. A gain equalizer according to claim 5 and wherein said detector is located such that it measures the power level of at least one of said wavelength components of said light in said input port.

9. A gain equalizer according to claim 5 and wherein said spectrally selective detector is a linear detector array utilizing one of said dispersive elements for performing said spectral selection.

10. A gain equalizer according to claim 5 and wherein said at least one signal corresponding to the power level of at least one of said wavelength components is obtained by means of a power splitter located in the path of said wavelength components of said light.

11. A gain equalizer according to claim 1 and wherein said phase changing element is a liquid crystal element.

12. A gain equalizer according to claim 1 and wherein at least one of said dispersive elements is a grating.

13. A gain equalizer according to claim 1 and also comprising a half wave plate serially with said plurality of attenuating elements, operative to reduce the polarization dependent loss of said gain equalizer

14. A gain equalizer comprising:

a port receiving light comprising at least two wavelength components;

a dispersive element receiving said light and spatially dispersing said wavelength components of said light along a dispersion direction;

a plurality of variable optical attenuating elements disposed generally along said dispersion direction, such that each of said attenuating elements is traversed by a different wavelength component of said light; and

a reflective surface operative to reflect light after passage through at least part of at least one of said plurality of variable optical attenuating elements back to said dispersive element, so as to combine said wavelength components of said reflected light into an output beam at said port;

wherein at least one of said variable optical attenuating elements comprises a variable phase changing element operative to change the phase of part of the cross section of light passing through it.

15. A gain equalizer according to claim 14, and wherein at least one of said attenuating elements is varied such as to vary the level of light traversing said attenuating element.

16. A gain equalizer according to claim 14 and wherein said port is an optical fiber.

17. A gain equalizer according to claim 15 and also comprising a controller operative to vary the attenuation of at least one of said variable attenuating elements, such that the light passing through said attenuating element has a predefined level.

18. A gain equalizer according to claim 17 and also comprising a spectrally selective detector providing to said controller at least one signal corresponding to the power level of at least one of said wavelength components.

19. A gain equalizer according to claim 18 and wherein said at least one signal is utilized to adjust the attenuation of at least one of said variable attenuating elements.

20. A gain equalizer according to claim 18 and wherein said detector is connected such that it measures the power level of at least one of said wavelength components in said output beam.

21. A gain equalizer according to claim 18 and wherein said detector is connected such that it measures the power level of at least one of said wavelength components of said light received at said port.

22. A gain equalizer according to claim 18 and wherein said spectrally selective detector is a linear detector array utilizing one of said dispersive elements for performing said spectral selection.

23. A gain equalizer according to claim 18 and wherein said at least one signal corresponding to the power level of at least one of said wavelength components is obtained by means of a power splitter located in the path of said wavelength components of said light.

24. A gain equalizer according to claim 14 and wherein said phase changing element is a liquid crystal element.

25. A gain equalizer according to claim 14 and wherein at least one of said dispersive elements is a grating.

26. A gain equalizer according to claim 14 and also comprising a quarter wave plate serially with said plurality of attenuating elements, operative to reduce the polarization dependent loss of said gain equalizer

27. A gain equalizer according to claim 14 and wherein said light received by said port and said output beam are separated by means of a dual fiber collimator.

28. A gain equalizer according to claim 14 and wherein said light received by said port and said output beam are separated by means of a circulator.

29. A multichannel optical gain equalizer comprising:

an input fiber receiving a multi-wavelength input;

a demultiplexer fed by said input fiber, having a plurality of output wavelength channels;

an output fiber outputting a multi-wavelength output;

a multiplexer feeding said output fiber, having a plurality of input wavelength channels;

a plurality of variable optical attenuating elements, individual ones of said attenuating elements being generally disposed between individual output channels of said demultiplexer and individual input channels of said multiplexer; and

at least one signal detector detecting the power in at least one of said input wavelength channels of said multiplexer, and operative to adjust the attenuation of said attenuating element associated with said at least one input wavelength channel, according to the power of said signal detected;

wherein at least one of said variable optical attenuating elements comprises a variable phase changing unit operative to change the phase of part of the cross section of light passing through it.

30. A multichannel gain equalizer according to claim 29, and wherein said at least one signal detector detecting the power in at least one of said input wavelength channels of said multiplexer is a spectrally selective detector in series with said output fiber.

31. A multichannel gain equalizer according to claim 29 and wherein said at least one signal detector is located remotely from said gain equalizer.

32. A multichannel gain equalizer according to claim 29, and wherein said demultiplexer comprises a dispersive grating, such that said plurality of output wavelength channels are spatially dispersed.

33. A multichannel gain equalizer according to claim 32 and wherein said multiplexer comprises a dispersive grating, such that said spatially dispersed plurality of wavelength channels are combined into one channel.

34. A multichannel gain equalizer according to claim 29 and wherein said phase changing element is a liquid crystal element.